PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-287587
(43)Date of publication of application : 19.10.1999

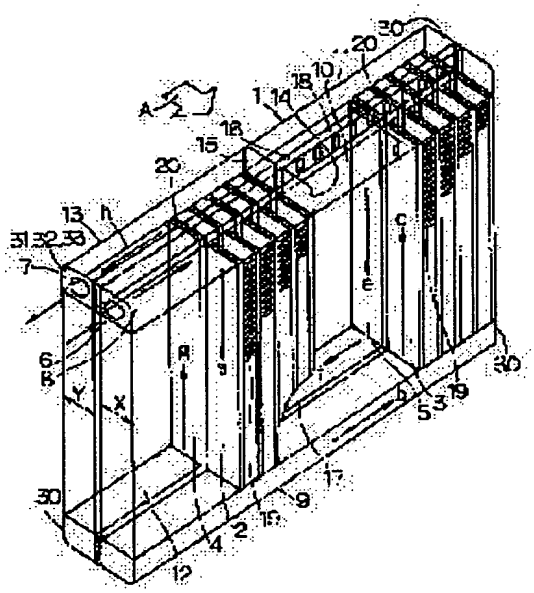
(51)Int.Cl. F28F 9/02

(21)Application number : 10-091833
(22)Date of filing : 03.04.1998

(71)Applicant : DENSO CORP
(72)Inventor : AZEYANAGI ISAO
MAKIHARA MASAMICHI
OHARA TOSHIO
KAMIYA SADAYUKI

(54) REFRIGERANT EVAPORATOR

(57)Abstract:
PROBLEM TO BE SOLVED: To simplify the structure through decrease in number of components while reducing pressure loss without requiring any special side refrigerant passage by making a bypath directly coupling tank parts in a wall partitioning a plurality of rows of tank parts contiguous in the flow direction of outer fluid.
SOLUTION: Two rows of tubes 2-5 arranged in the air flow direction A of an evaporator 1 are flat tubes constituting a refrigerant passage. Tank parts 8-13 on the refrigerant side of the evaporator 1 distribute or collect refrigerant to/from the tubes 2-5 wherein the inlet tank parts 8-10 are disposed on the downstream side of air flow and outlet tank parts 11-13 are disposed on the upstream side. Partition walls 16, 17 are formed over the entire length between the upper tank parts 8, 13 and 10, 11 and between lower tanks 9, 12. A plurality of bypaths 18 are provided at the part of a partition wall 16 partitioning the tanks 10, 11. This structure simplifies the structure while reducing pressure loss.



LEGAL STATUS

[Date of request for examination] 20.10.2004
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] While carrying out two or more trains arrangement of the tube (2-5) for pouring a refrigerant in the flow direction (A) of an external fluid The parallel arrangement of a majority of these tubes (2-5) is carried out in the flow direction (A) and the rectangular direction of said external fluid. The tank section (8-13) which gather refrigerant distribution in said tube (2-5) or the refrigerant from said tube (2-5) to the both ends of said tube (2-5) is arranged. Corresponding to the tube (2-5) of said two or more trains, two or more trains arrangement of said tank section (8-13) is carried out in the flow direction (A) of said external fluid. In the refrigerant evaporator made to flow out of a refrigerant outlet (7) after carrying out the multiple-times turn of the refrigerant which flows from a refrigerant inlet port (6) in the passage which passes said tank section (8-13) and said tube (2-5) The refrigerant evaporator characterized by establishing a bypass path means (18) to link the tank section of these two or more trains with the bridgewall (16 17) which divides the tank section of two or more trains which adjoin among said tank sections (8-13) in the flow direction (A) of said external fluid directly.
[Claim 2] While carrying out two or more trains formation of the tube (2-5) for pouring a refrigerant in the flow direction (A) of an external fluid The parallel arrangement of a majority of these tubes (2-5) is carried out in the flow direction (A) and the rectangular direction of said external fluid. The tank section (8-13) which gather refrigerant distribution in this tube (2-5) or the refrigerant from this tube (2-5) to the both ends of said tube (2-5) is arranged. In the refrigerant evaporator which carries out two or more trains arrangement of said tank section (8-13) in the flow direction (A) of said external fluid corresponding to the tube (2-5) of said two or more trains It is located in the end side of said tube (2-5) among said tank sections (8-13). And the tank section (8) located in the flow direction downstream of said external fluid is made to open a refrigerant inlet port (6) for free passage. It is located in the end side of said tube (2-5) among said tank sections (8-13). And the tank section (13) located in the improvement style side in a way to which said external fluid flows is made to open a refrigerant outlet (7) for free passage. To the side of the tank section (8) which was open for free passage at said refrigerant inlet port (6), and the tank section (13) which was open for free passage to said refrigerant outlet (7) The tank section (10) and the tank section (11) are formed through a diaphragm (14 15), respectively. The refrigerant evaporator characterized by establishing a bypass path means (18) to link both this tank section (10 11) with the bridgewall (16) which divides between the tank section (10) of said latter, and the tank section (11) directly.
[Claim 3] Said bypass path means is a refrigerant evaporator according to claim 1 characterized by being the bypass hole (18) prepared in the flow direction (A) and the rectangular direction of said external fluid. [two or more]
[Claim 4] Claim 1 characterized by joining them to one after forming said tube (2-5) and said tank section (8-13) with another object thru/or the refrigerant evaporator of any one publication of three.
[Claim 5] After forming said tube (2-5) and said tank section (8-13) with another object, they are joined to one. While said tank section (8-13) bends a metal thin plate (34), is formed and forms said bridgewall (16 17) by said metal thin plate (34) The refrigerant evaporator according to claim

1 or 2 characterized by [redacted]stituting said bypass path means (18) [redacted]e hole (34a) made in said metal thin plate (34).

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used for the air conditioner for cars about the refrigerant evaporator which evaporates the refrigerant of a refrigerating cycle, for example, is suitable.
[0002]
[Description of the Prior Art] These people have proposed the refrigerant evaporator which had previously the refrigerant passage configuration shown in drawing 17 in JP,9-170850,A. In the refrigerant evaporator 1 of this point **, the inlet-port tanks 50 and 51 and the outlet tanks 52 and 53 are formed in those vertical both ends, to flow direction A of ventilation air, the refrigerant entrance-side heat exchange section X is carried out at the air downstream, and partition formation of the refrigerant outlet side heat exchange section Y is carried out at the air upstream.
[0003] And while joining a metallic thin plate in the shape of two-sheet midst doubling and constituting a tube (refrigerant path) from this evaporator 1, the above-mentioned tanks 50-53 are fabricated to one by the lobe of the shape of a bowl of the both ends of this metallic thin plate. In the evaporator 1 of such a configuration, a refrigerant flows the interior according to the following path. That is, in drawing 17 , a refrigerant goes into 1st inlet-port tank section 51a of the bottom inlet-port tank 51 through the side refrigerant path 55 of an evaporator side face from refrigerant inlet-port 54a of the piping joint 54. And from this 1st inlet-port tank section 51a, a refrigerant goes up leeward side refrigerant path ** in a tube, and goes into the top inlet-port tank 50. Next, a refrigerant descends leeward side refrigerant path ** in a tube from the top inlet-port tank 50, and goes into 2nd inlet-port tank section 51b of the bottom inlet-port tank 51.
[0004] Next, a refrigerant goes into 1st outlet tank section 52a of the top outlet tank 52 through the side refrigerant path 56 of an evaporator side face from 2nd inlet-port tank section 51b, descends windward refrigerant path ** in a tube from here, and goes into the bottom outlet tank 53. Next, a refrigerant goes up windward refrigerant path ** in a tube from this bottom outlet tank 53, and goes into 2nd outlet tank section 52b of the top outlet tank 52.
[0005] Next, a refrigerant flows from 2nd outlet tank section 52b to refrigerant outlet 54b through the side refrigerant path 57 of an evaporator side face, and flows into the evaporator exterior. Thus, while carrying out the refrigerant entrance-side heat exchange section X at the air downstream and carrying out partition formation of the refrigerant outlet side heat exchange section Y to the flow of the ventilation air A at the air upstream, respectively, in the refrigerant entrance-side heat exchange section X and the refrigerant outlet side heat exchange section Y, the flow direction of a refrigerant is made in agreement. That is, it divides in drawing 17 , the refrigerant flow direction of both the heat exchange sections X and Y is made above on the right of the sections 58 and 59, and the refrigerant flow direction of both the heat exchange sections X and Y is made down on the left of the partition sections 58 and 59.
[0006] Even if the liquid phase refrigerant of a vapor-liquid 2 phase refrigerant and a gaseous-phase refrigerant are distributed to an ununiformity to refrigerant path [in a tube 2] ** - ** by

considering as such a refrigerant path configuration, he divides evaporator blow-off air temperature into the whole region of an evaporator 1, and is trying to equalize by offsetting the ununiformity of refrigerant distribution before and behind air flow direction A. Moreover, since a refrigerant flows moving refrigerant path [of the refrigerant entrance-side heat exchange section X located in the air downstream] **, ** and refrigerant path [of the refrigerant outlet side heat exchange section Y located in the air upstream] **, and ** in a zigzag direction as shown in drawing 17 , it becomes the heat exchange of a rectangular counterflow mold, the amount of endoergic of a refrigerant increases, and refrigeration capacity can be improved.
[0007]
[Problem(s) to be Solved by the Invention] According to the above-mentioned conventional technique, by the way, for connection to refrigerant path ** of the refrigerant entrance-side heat exchange section X, and refrigerant path ** of the refrigerant outlet side heat exchange section Y The side refrigerant path 56 is needed for one side face of an evaporator. In the side face of another side of an evaporator Connection to refrigerant path ** of the refrigerant outlet side heat exchange section Y, and refrigerant outlet 54b, And the side refrigerant paths 57 and 55 are needed for connection to refrigerant path ** of the refrigerant entrance-side heat exchange section X, and refrigerant inlet-port 54a.
[0008] For this reason, two metallic thin plates must be arranged to each both-sides side of right and left of an evaporator, and the above-mentioned side refrigerant paths 55, 56, and 57 must be formed in it between this metallic thin plate of two sheets, respectively. Therefore, as compared with the usual evaporator configuration, by addition of the side refrigerant paths 55-57, component part mark increase and a manufacturing cost becomes high. Moreover, it originates in the passage diaphragm by the passage die length by the side refrigerant paths 55-57, and the side refrigerant paths 55-57 etc., the pressure loss of the whole evaporator increases, the rise of a refrigerant evaporation pressure, as a result refrigerant evaporation temperature is caused, and it becomes the cause of the degradation of an evaporator.
[0009] This invention was made in view of the point describing above, and carries out two or more trains arrangement of the tank section and the tube before and behind the flow direction of an external fluid, and it aims at aiming at the simplification and pressure-loss reduction by reduction of component part mark in the evaporator with which a refrigerant flows, moving the refrigerant path by these tank sections and tubes in a zigzag direction.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, it is characterized by establishing a bypass path means (18) to link the tank section of these two or more trains with the bridgewall (16 17) which divides with invention according to claim 1 the tank section (8-13) of two or more trains which adjoin in the flow direction (A) of an external fluid directly.
[0011] According to this, since the bypass path means (18) for obtaining the turn configuration of refrigerant flow can be constituted very easily using bridgewall (16 17) itself, it is not necessary to add a side refrigerant path on an evaporator side face specially like the conventional technique. Consequently, the component part for a side refrigerant path becomes unnecessary, and only the part can attain simplification of an evaporator configuration and can reduce a manufacturing cost. And since a bypass path means (18) links directly the tank section (10 11) of two or more trains which adjoin in the flow direction (A) of an external fluid, it can reduce the pressure loss of the whole evaporator and can aim at improvement in the engine performance of an evaporator.
[0012] Moreover, the tank section which was open for free passage at the refrigerant inlet port (6) in invention according to claim 2 (8), To the side of the tank section (13) which was open for free passage to the refrigerant outlet (7), and, respectively The tank section (10) and the tank section (11) are formed through a diaphragm (14 15). A bypass path means (18) to link both this tank section (10 11) with the bridgewall (16) which divides between the tank section (10) of this latter and the tank section (11) directly is established, and the same operation effectiveness as claim 1 can be done so.
[0013] Moreover, a bypass path means can consist of bypass holes (18) prepared in the flow

direction (A) and the rectangular direction of an external fluid like invention according to claim 3. [two or more] Moreover, if they are joined to one like invention according to claim 4 after forming a tube (2-5) and the tank section (8-13) with another object, the thinning of the board thickness of a tube (2-5) can be carried out, and improvement in the heat exchange engine performance and a miniaturization can be attained by detailed-ization of the heat exchange section. And in the tank section (8-13) which is not related to the heat exchange engine performance, a tube can set up the board thickness uniquely from a viewpoint of reservation on the strength independently, and the need reinforcement of the tank section can be secured easily.

[0014] In invention according to claim 5, furthermore, a tube (2-5) and the tank section (8-13) When joining to one after forming with another object, while bending and forming the tank section (8-13) from a metal thin plate (34) and fabricating a bridgewall (16 17) by this metal thin plate (34) It is characterized by constituting a bypass path means (18) by the hole (34a) made in this metal thin plate (34).

[0015] According to this, by the common metal thin plate (34) of one sheet which constitutes the tank section (8-13), the tank section (8-13), a bridgewall (16 17), and a bypass path means (18) can be constituted, and a manufacturing cost can be reduced much more effectively. In addition, the sign in the parenthesis of each above-mentioned means shows correspondence relation with the concrete means given in an operation gestalt mentioned later.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on drawing.

(The 1st operation gestalt) Drawing 1 shows the 1st operation gestalt which applied this invention to the refrigerant evaporator in the refrigerating cycle of the air conditioner for automobiles, and shows the outline of the whole configuration of an evaporator. An evaporator 1 carries out the vertical direction of drawing 1 up and down, and is installed in the air-conditioning unit case of the air conditioner for automobiles which is not illustrated. Air is ventilated in the direction of arrow-head A by the blower which is not illustrated to an evaporator 1, and this ventilation air (external fluid) and refrigerant carry out heat exchange.

[0017] The evaporator 1 has the tubes 2, 3, 4, and 5 arranged two trains at air flow direction A. These tubes 2-5 are flat tubes which constitute a cross-section flat-like refrigerant path altogether. And this parallel arrangement of many tubes 2-5 is carried out in air flow direction A and the rectangular direction, respectively. Here, the 1st tube 2 and 3 of the air downstream constitutes the refrigerant path of the refrigerant entrance-side heat exchange section X, and the 2nd tube 4 and 5 of the air upstream constitutes the refrigerant path of the refrigerant outlet side heat exchange section Y.

[0018] The vapor-liquid 2 phase refrigerant of low-temperature low voltage which the refrigerant inlet port 6 was decompressed by the temperature actuation type expansion valve (reduced pressure means) which a refrigerating cycle does not illustrate, and expanded flows. Moreover, the refrigerant outlet 7 is for making the gas refrigerant which was connected to compressor inhalation piping which is not illustrated and evaporated with the evaporator 1 flow back to a compressor inlet side. Moreover, in this example, the refrigerant inlet port 6 and the refrigerant outlet 7 are arranged in the upper part on the left-hand side of an evaporator 1, and are opening the refrigerant inlet port 6 for free passage in the entrance-side tank section 8 located in upside left-hand side. Moreover, the refrigerant outlet 7 is open for free passage in the outlet side tank section 13 located in upside left-hand side.

[0019] Here, if the tank sections 8-13 of an evaporator 1 are explained concretely, each tank sections gather distribution of the refrigerant to tubes 2-5, or the refrigerant from tubes 2-5, and are arranged two trains at air flow direction A corresponding to the 1st tube 2 and 3 and the 2nd tube 4 and 5. That is, the entrance-side tank sections 8-10 are located in the air flow downstream, and the outlet side tank sections 11-13 are located in the air flow upstream.

[0020] And it is divided by the diaphragm 14 between the upside entrance-side tank sections 8 and 10, and is divided by the diaphragm 15 between the upside outlet side tank sections 11 and 13. On the other hand, the lower entrance-side tank section 9 and the lower outlet side tank

section 12 are open for free passage without a partition as one passage covering the crosswise overall length of an evaporator 1.
[0021] In the refrigerant entrance-side heat exchange section X, the end section (upper limit section) of the left-hand side tube 2 is open for free passage in the upside entrance-side tank section 8, and is opening the other end (lower limit section) for free passage in the lower entrance-side tank section 9. Similarly, the end section (upper limit section) of the right-hand side tube 3 is open for free passage in the upside entrance-side tank section 10, and is opening the other end (lower limit section) for free passage in the lower entrance-side tank section 9. Moreover, in the refrigerant outlet side heat exchange section Y, the end section (upper limit section) of the left-hand side tube 4 is open for free passage in the upside outlet side tank section 13, and is opening the other end (lower limit section) for free passage in the lower outlet side tank section 12. Similarly, the end section (upper limit section) of the right-hand side tube 5 is open for free passage in the upside outlet side tank section 11, and is opening the other end (lower limit section) for free passage in the lower outlet side tank section 12.
[0022] By the way, among the upside tank sections 10 and 11 and among the lower tank sections 9 and 12, the bridgewalls 16 and 17 all prolonged covering the crosswise overall length of an evaporator 1 are formed between the tank sections 8 and 13 of the upper part which adjoins in air flow direction A. These bridgewalls 16 and 17 are formed in the tank sections 8-13 and one so that it may mention later.
[0023] However, the bypass hole (bypass path means) 18 which links the tank sections 10 and 11 directly is established in the part of the right-hand side into which it divides among the upside bridgewalls 16 between the tank sections 10 and 11. that in which two or more these bypass holes 18 are established — it is — more — concrete — tubes 3 and 5 — respectively — — corresponding — these tubes 3 and 5 and same number ****** — things are desirable because of the refrigerant distributivity improvement to each tube.
[0024] Here, the bypass hole 18 can pierce and process two or more coincidence into the metal sheet metal (aluminum etc.) which constitutes a bridgewall 16 by press working of sheet metal, and the configuration of the bypass hole 18 has the shape of a rectangle as shown in drawing 1 . Furthermore, the opening area and the array of the bypass hole 18 are set up so that the refrigerant distributivity to each tube may become the optimal.
[0025] The corrugated fin 19 fabricated by the wave is arranged between [of each tubes 2-5] mutual, and the corrugated fin 19 is joined to one by the flat side of each tubes 2-5. Moreover, the inner fin 20 fabricated by the wave is arranged inside each tubes 2-5, and while aiming at reinforcement of each tubes 2-5 by joining the wave-like crowning of this inner fin 20 to each tube internal surface, improvement in the engine performance by increase of a refrigerant side heating area is aimed at. In addition, it is joined to one by soldering that it seems that it mentions later, and the evaporator 1 whole shown in drawing 1 is **** with a group.
[0026] Next, if an operation of the evaporator by the 1st operation gestalt is explained in the above-mentioned configuration, the vapor-liquid 2 phase refrigerant of low-temperature low voltage decompressed by the expansion valve which is not illustrated is not involved refrigerant inlet-port 6, but flows in the upper-tank section 8 of the air downstream, will be distributed to two or more tubes 2, and will flow a tube 2 below like an arrow head a here. After that, after a refrigerant flows the lower tank section 9 to the method of the right like an arrow head b, it is distributed to two or more tubes 3, and it flows this tube 3 upwards like an arrow head c.
[0027] And a refrigerant passes through the bypass hole 18 which flowed in the upside tank section 10, next was able to be made in the bridgewall 16 like an arrow head d, shifts to the air upstream from the air downstream, and flows in the upper-tank section 11 of the air upstream. Next, a refrigerant is distributed to two or more tubes 5 from this upper-tank section 11, a tube 5 is flowed below like an arrow head e, and it flows into the right-hand side section of the lower-tank section 12.
[0028] Next, after a refrigerant shifts the lower-tank section 12 to left-hand side from right-hand side like an arrow head f, it is distributed to two or more tubes 4, and flows this tube 4 upwards like an arrow head g. The appropriate back, the refrigerants from a tube 4 gather within the upper-tank section 13, shift this upper-tank section 13 to left-hand side from right-hand

side like an arrow head [redacted]d flow out of the refrigerant outlet 7 [redacted] the exterior of an evaporator 1.

[0029] On the other hand, ventilation air (air-conditioning air) is ventilated in the direction of arrow-head A, and passes the opening section of the core section for heat exchange constituted with tubes 2-5 and the corrugated fin 19. In this case, when the refrigerant in a tube 2-5 carries out endoergic and evaporates from ventilation air, ventilation air is cooled, and it becomes cold blast, it blows off to the vehicle interior of a room, and the vehicle interior of a room is air-conditioned. By the way, in the above-mentioned evaporator 1, since the refrigerant entrance-side heat exchange section X which consists of letter passage of meandering of the refrigerant entrance side shown by arrow-head a-c is arranged to the downstream of air flow direction A and the refrigerant outlet side heat exchange section Y which consists of letter passage of meandering of a refrigerant outlet side shown by arrow-head e-h is arranged to the upstream of air flow direction A, heat exchange of rectangular counterflow with the sufficient heat transfer engine performance can be performed between a refrigerant and air.

[0030] And the refrigerant passage before and behind an air flow direction can be connected, without needing side refrigerant paths 55-57 like the conventional technique which shows between the tank sections 10 and 11 located before and after air flow direction A in drawing 17 since it is directly open for free passage with the bypass hole 18 made in the bridgewall 16. Therefore, while being able to attain compaction of the whole evaporator configuration, pressure-loss reduction of the refrigerant passage of the whole evaporator can be aimed at. By pressure-loss reduction of this refrigerant passage, a refrigerant evaporation pressure can be reduced, and refrigerant evaporation temperature can be reduced, consequently the cooling engine performance of an evaporator can be improved.

[0031] Furthermore, in the refrigerant style which flows two or more tubes 3 and two or more tubes 5 to juxtaposition like arrow heads c and e, refrigerant distribution in two or more tubes 3 and 5 can be equalized by optimizing two or more opening area and arrays of the bypass hole 18. A refrigerant is uniformly evaporated throughout the heat exchange section containing tubes 3 and 5 by this, and improvement in the engine performance can be realized.

[0032] Next, the concrete configuration and the manufacture approach of an evaporator 1 by the 1st operation gestalt are explained. Drawing 2 illustrates the tank sections 8-13, and forms the upside tank sections 8, 10, 11, and 13 by bending the sheet metal material made from aluminum of one sheet. And the bridgewall 16 consists of the central bending sections. Similarly, when the lower tank sections 9 and 12 and a lower bridgewall 17 also bend the sheet metal material made from aluminum of one sheet, it forms. The board thickness of the sheet metal material made from aluminum secures the reinforcement of the tank section on which the big stress by refrigerant pressure acts as about 0.6mm as compared with a tube.

[0033] As an example of the concrete quality of the material of the above-mentioned aluminum sheet metal material, the clad of the wax material (A No. 4000 system) is carried out to a medial surface, and the single-clad material which allotted the core material (A No. 3000 system) to the lateral surface is used. In this case, corrosion resistance may be raised as sandwiches structure which prepared sacrifice corrosion material (for example, aluminum-1.5wt%Zn) in the lateral surface of a core material. Next, drawing 3 (a) shows the cross-section configuration of tubes 2-5, and tubes 2-5 constitute the cross-section flat-like path configuration by bending the sheet metal material made from aluminum of one sheet. Here, the internal refrigerant path 21 in a tube 2-5 is divided into many small paths by junction of the wave crowning of the inner fin 20.

[0034] As an example of the concrete quality of the material of the sheet metal material made from aluminum of a tube, as shown in drawing 3 (b), the aluminum raise in basic wages material which formed the sacrifice corrosion material (for example, aluminum-1.5wt%Zn) 23 in the lateral surface of the core material 22 of A No. 3000 system can be used. The board thickness t of the sheet metal material made from aluminum of a tube can carry out thinning to about 0.25-0.4mm according to the reinforcement operation by the inner fin 20. Tube height h can be made low to about 1.75mm by the thinning of this tube board thickness t. The inner fin 20 consists of aluminum raise in basic wages material of A No. 3000 system.

[0035] And wax material (A No. 4000 system) is applied to a junction need part like drawing 3 (c)

for junction on tubes 2-[redacted]nd the inner fin 20. That is, the paste-[redacted]wax material (A No. 4000 system) 24a and 24a is applied to the medial surface of the both ends of this tube sheet metal material 24 before bending processing of the sheet metal material 24 made from aluminum which constitutes tubes 2-5. Similarly, before incorporating the inner fin 20 in a tube, paste-like wax material (A No. 4000 system) 20a is applied to the wave crowning of the inner fin 20.

[0036] This wax material spreading can perform junction of the both-ends comrade of the tube sheet metal material 24, and junction in the internal surface of the tube sheet metal material 24, and the wave crowning of the inner fin 20 at the time of one soldering of the whole evaporator. In addition, if the single-clad material which carried out the clad of the wax material to the medial surface as the quality of the material of the tube sheet metal material 24 is used, the above-mentioned wax material spreading will become unnecessary. Moreover, it is good even if unnecessary [in wax material spreading in the wave crowning of the inner fin 20] using the double clad material which carried out the clad of the wax material to both sides as the quality of the material of the inner fin 20.

[0037] Next, drawing 4 is an example of the joint of the tank sections 8-13 and the both ends of tubes 2-5, and the tube insertion hole 26 where the both ends 25 of tubes 2-5 are inserted is made in the flat side of the tank sections 8-13. Here, in order to make easy insertion into the hole 26 of the both ends 25 of tubes 2-5, both ends 25 are formed in the configuration shown in drawing 5 .

[0038] That is, the edge limb 27 of the tube joint shown in drawing 3 (a) is deleted at the tube both ends 25, notch 27a is formed, and the tube both ends 25 are formed in an abbreviation ellipse-like configuration. Since this notch 27a plays the role of the positioning stopper when inserting the both ends 25 of tubes 2-5 in the tube insertion hole 26 of the tank sections 8-13 as shown in drawing 5 (e), it becomes easy to tube insertion work it to the tank section. In addition, in drawing 5 (e), outline illustration only of the tank section of one side before and behind air flow direction A is carried out among the tank sections 8-13.

[0039] Here, the insertion hole 26 serves as a burring configuration which is the thing of the shape of an ellipse corresponding to the both ends 25 of tubes 2-5, and hammered out ellipse-like ****** 26a to the method side of the outside of a tank. Thereby, the tank sections 8-13 and tubes 2-5 are joinable using the wax material of the medial surface of the tank sections 8-13. In addition, what is necessary is to apply wax material only to the both ends 25 of tubes 2-5 in the state of the tube simple substance, and just to join the tank sections 8-13 and tubes 2-5 using this wax material, when hammering out ****** 26a of the tube insertion hole 26 of the tank sections 8-13 to the tank inside like drawing 6 .

[0040] Drawing 7 is the corrugated fin (outer fin) 19 joined to the tube lateral surface, and has started well-known louver 19a aslant. After it forms 19 by the aluminum raise in basic wages material of this corrugated fin system of No.A3000 and it applies wax material 19b only to the wave crowning which is a junction (soldering) part with a tube, it carries out with [of the corrugated fin 19 and tubes 2-5] a group.

[0041] Drawing 8 illustrates the structure with a group of diaphragms 14 and 15, and two diaphragms 14 and 15 are really fabricated in this example by the plate 27 of one sheet for simplification with a group. As an example of the quality of the material of this plate 27 (diaphragms 14 and 15), the double clad material which carried out the clad of the wax material (A No. 4000 system) is used for both sides of a core material (A No. 3000 system).

[0042] Slit slot 27a which fits into the bridgewall 16 of tanks 11 and 13 and tanks 8 and 10 is formed in the plate 27. On the other hand, among tanks 11 and 13 and among tanks 8 and 10, the slit slots 28 and 29 for insertion of diaphragms 14 and 15 are formed, respectively. Fitting slit slot 27a into a bridgewall 16, by inserting diaphragms 14 and 15 in the slit slots 28 and 29, using the wax material of both sides of a plate 27, and the wax material of the tank inside, diaphragms 14 and 15 are soldered on tanks 10-13, and it divides between tanks 11 and 13 and between tanks 8 and 10, respectively. In addition, diaphragms 14 and 15 may be completely divided into two members, and, of course, you may solder with [above] a group.

[0043] Drawing 9 shows the covering device material 30 of tanks 8-13, and the covering device material 30 is arranged at other three places other than the part in which the refrigerant inlet

port 6 and the refrigerant outlet 7 are established among the edges of a tank longitudinal direction (drawing 1 longitudinal direction). This covering device material 30 carries out press forming of the single-clad material which carried out the clad of the wax material only to that medial surface, and is fabricated by the bowl-like configuration. And the covering device material 30 is fitted into the external surface side of a tank longitudinal direction edge, the covering device material 30 is soldered at the tank longitudinal direction edge using the wax material of the medial surface of the covering device material 30, and opening of a tank longitudinal direction edge is blockaded.

[0044] Next, drawing 10 - drawing 12 show the example of structure of the piping joint block section, it is soldered at the tank longitudinal direction edge, and is joined to a tank longitudinal direction edge like the covering device material 30 mentioned above, and the covering device material 31 of drawing 11 carries out press forming of the double clad material which carried out the clad of the wax material to both sides. As shown in drawing 11 , the tank section 8, the refrigerant inlet port 6 open for free passage, and the tank section 13 and the refrigerant outlet 7 open for free passage are established in this covering device material 31.

[0045] As it consists of raise in basic wages material of A No. 3000 system which is not carrying out the clad of the wax material and is shown in drawing 12 , the middle plate member 32 is making the refrigerant inlet port 6, entrance-side opening 32a open for free passage and the refrigerant outlet 7, and outlet side opening 32b open for free passage penetrate, and is projecting and fabricating lobe 32c aslant from the part of entrance-side opening 32a. The body member 33 of joint is joined to the middle plate member 32. This body member 33 of joint consists of single-clad material which carried out the clad of the wax material only to that medial surface. It applies to the joint covering member 33 at the point of lobe 32c from the part of entrance-side opening 32a of the middle plate member 32, wrap semicircle tubed path formation section 33a is formed in the shape of a bowl, and end-connection 33b is carrying out opening to the point of this path formation section 33a. Moreover, from the plate surface, to the joint covering member 33, outlet side opening 32b of the middle plate member 32 and body 33c open for free passage project, and are fabricated.

[0046] End-connection 33b is connected to the outlet section of the refrigerant decompressed by the expansion valve, and body 33c is connected to the inlet-port section of the gas refrigerant temperature sensor of an expansion valve. While three persons of the covering device material 31, the middle plate member 32, and the body member 33 of joint are joined to one by soldering by the above configuration, it is the piping pitch P1 of the tank section 8, the refrigerant inlet port 6 by the side of 13, and the refrigerant outlet 7. It compares and is the piping pitch P2 by the side of an expansion valve. When small, it is this piping pitch P1 and P2. It can consider as the configuration which can absorb a gap.

[0047] Next, drawing 13 (a), (b), and (c) illustrate three concrete gestalten of the bypass hole 18 mentioned above. The bypass hole 18 of drawing 13 (a), (b), and (c) consists of burring holes (hole configuration with the printing section) which were able to be made in the central partition section (bending section) 16 of the tank sections 10 and 11 of the upper part formed by each bending the sheet metal material made from aluminum of one sheet.

[0048] Drawing 14 illustrates the concrete formation approach of the bypass hole 18, and as shown in drawing 14 (a), it forms punching hole 34b with the magnitude which can insert the printing section of burring hole 34a and this burring hole 34a in the sheet metal material 34 made from aluminum which constitutes the upside tank sections 8, 10, 11, and 13 first by press working of sheet metal. Next, as shown in drawing 14 (b), the part which pierced with burring hole 34a and formed hole 34b is bent in the shape of U character. Next, as shown in drawing 14 (c), the printing section of burring hole 34a is pierced, and it inserts in hole 34b. Next, as shown in drawing 14 (d), the tip of the printing section of burring hole 34a is closed to a periphery side. Thereby, the return of the insertion condition of the printing section of burring hole 34a can be prevented, and formation of the bypass hole 18 can be completed.

[0049] If the advantage by the manufacture approach mentioned above is described below, after forming ** tank sections 8-13 with tubes 2-5 and another object At the same time it thickens board thickness of the sheet metal material 34 which constitutes the tank sections 8-13 and

raises reinforcement, since it joins to one about tubes 2-5 The board thickness can be made sufficiently thin, detailed-ization of tubes 2-5 and the corrugated fin 19 can be advanced, and miniaturization of a refrigerant evaporator and high performance-ization can be attained by things.

[0050] ** Since the tank sections 8-13 can be constituted from bending processing of the sheet metal material 34 made from aluminum of one sheet, it becomes unnecessary to attach wax material to the external surface side of the sheet metal material 34, and the corrosion resistance of the tank section can be improved.

** Also in tubes 2-5, since it is not necessary to attach wax material to an external surface side, corrosion resistance can be improved. Moreover, in order not to attach wax material to the external surface side of tubes 2-5, formation of a surface treatment layer becomes good and wastewater nature improves. Moreover, the stinking thing generating suppression effectiveness in a refrigerant evaporator becomes high with improvement in wastewater nature.

[0051] ** In order not to attach wax material in the corrugated fin 19 section, formation of a surface treatment layer becomes good. Consequently, improvement in wastewater nature and improvement in the stinking thing generating suppression effectiveness can be demonstrated like the above-mentioned **.

(The 2nd operation gestalt) Drawing 15 shows the 2nd operation gestalt, inserts the diaphragm 35 which has restriction 35a in the slit slot 36 established in the location of the arbitration of the tank sections 8-13, and improves the refrigerant distributivity (equalization of distribution) to two or more tubes 2-5. In addition, the quality of the material of a diaphragm 35 etc. is the same as that of the diaphragms 14 and 15 of drawing 8 R> 8, and good.

[0052] Drawing 16 shows the example of concrete arrangement of the above-mentioned diaphragm 35, and diaphragm 35-** is arranged between the tube 2 and the tube 3 in the lower entrance-side tank 9. Here, since both the refrigerant outlets from tube 5 group through which the refrigerant inlet port to tube 3 group and the refrigerant which came out of tube 3 group pass are located in the center section of the longitudinal direction of drawing 1 in case a refrigerant flows in the direction of arrow-head b within the lower entrance-side tank 9, the refrigerant flow of the direction of arrow-head b tends to flow the center-section approach location of drawing 1 simplistically among tube 3 group and tube 5 group.

[0053] However, according to the 2nd operation gestalt, it is ****** to raise the rate of a refrigerant style and to fly a refrigerant to the method of the right-hand side back of the entrance-side tank 9 from extracting a refrigerant style by restriction 35a of diaphragm 35-**. Consequently, a refrigerant can be enough poured also in the tube 3 of the method of the right-hand side back among many tube 3 groups, and refrigerant distribution in tube 3 group and tube 5 group can be improved further.

[0054] Moreover, diaphragm 35-** of drawing 16 is arranged in the lower outlet side tank 12 at least in the pars intermedia of tube 4 group. Here, by the lower outlet side tank 12, since the refrigerant inlet port to tube 4 group is located in the center section of the longitudinal direction of drawing 1 and the outlet of the refrigerant to which it came out of tube 4 group is located in the left end side of the longitudinal direction of drawing 1 in case a refrigerant flows in the direction of arrow-head f, it is going to concentrate the refrigerant flow of the direction of arrow-head f on the location of the left end approach of drawing 1 among tube 4 groups.

[0055] However, according to the 2nd operation gestalt, it can control that extract refrigerant flow by restriction 35a of diaphragm 35-**, and refrigerant flow concentrates to the method of the left-hand side back. Consequently, a refrigerant can be enough poured also in the center-section approach tube 4 among many tube 4 groups, and refrigerant distribution in tube 4 group can be improved further.

[Translation done.]

JAPANESE [JP,11-287587,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline perspective view of the refrigerant evaporator by the 1st operation gestalt of this invention.
[Drawing 2] It is the side elevation showing the end-face configuration of the tank section of drawing 1 .
[Drawing 3] The explanatory view of the example of the quality of the material of a tube and (c of the sectional view in which (a) shows the cross-section configuration of the tube of drawing 1 , and (b)) are the explanatory views of wax material spreading to a tube configuration member.
[Drawing 4] It is the sectional view of the fitting section of the tank section of drawing 1 , and a tube.
[Drawing 5] (a) — the top view of the tube edge of drawing 1 , and (b) — the front view of a tube edge, and (c) — a part of (b) — it is an approximate account Fig. in the condition with a group that an enlarged drawing and (d) inserted the tube edge in the expansion perspective view of (a), and (e) inserted it in the tank section.
[Drawing 6] It is the sectional view showing other examples of the fitting section of the tank section of drawing 1 , and a tube.
[Drawing 7] It is the explanatory view of wax material spreading on the corrugated fin of drawing 1 .
[Drawing 8] It is an expansion perspective view in the decomposition condition of the diaphragm section of drawing 1 .
[Drawing 9] It is the perspective view of the covering device material of the tank section of drawing 1 .
[Drawing 10] It is the perspective view of the piping joint section of drawing 1 .
[Drawing 11] It is the perspective view of the covering device material in the piping joint section of drawing 10 .
[Drawing 12] (a) is [the B-B sectional view of (a) and (c of the front view of the piping joint section of drawing 10 and (b))] the front views of a middle plate member.
[Drawing 13] It is the sectional view of the bypass hole of drawing 10 .
[Drawing 14] It is the sectional view for explanation of the formation approach of the bypass hole of drawing 10 .
[Drawing 15] It is the decomposition perspective view showing the attachment structure of the diaphragm with restriction by the 2nd operation gestalt of this invention.
[Drawing 16] It is the outline perspective view of an evaporator which illustrates the concrete arrangement location of the diaphragm with restriction by the 2nd operation gestalt of this invention.
[Drawing 17] It is the outline perspective view showing the refrigerant path configuration of the conventional evaporator.
[Description of Notations]
2-5 [— 16 The tank section, 17 / — A bridgewall, 18 / — Bypass hole.] — A tube, 6 — A refrigerant inlet port, 7 — A refrigerant outlet, 8-13

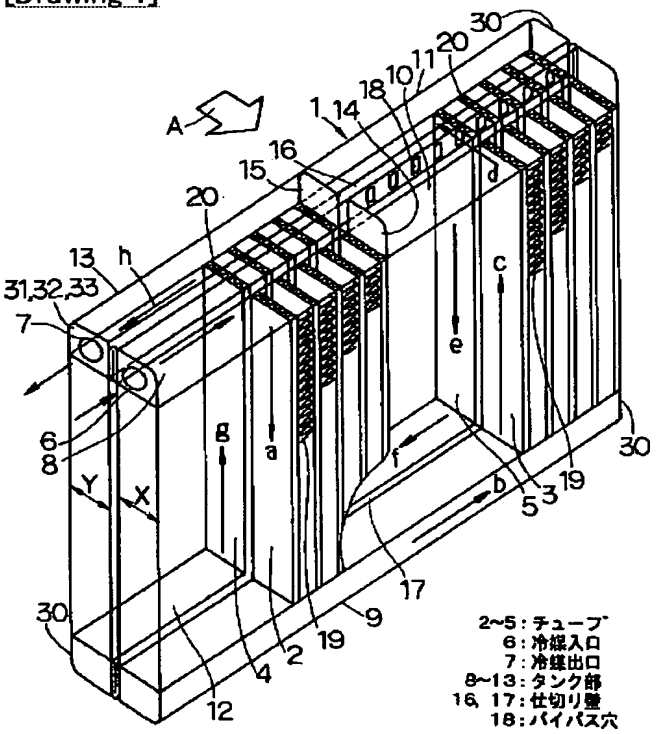
[Translation done.]

* NOTICES *

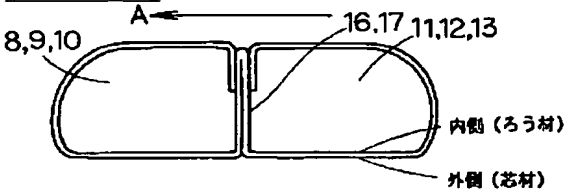
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

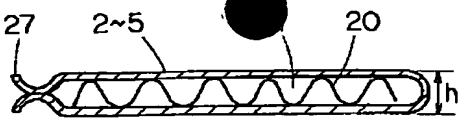


[Drawing 2]

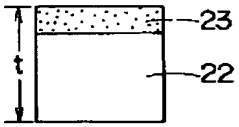


[Drawing 3]

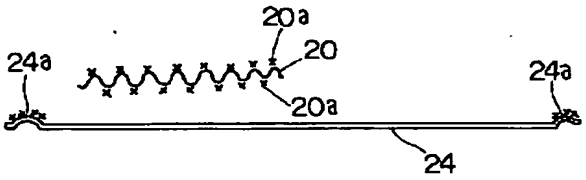
(a)



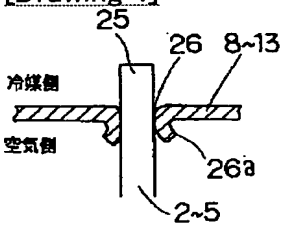
(b)



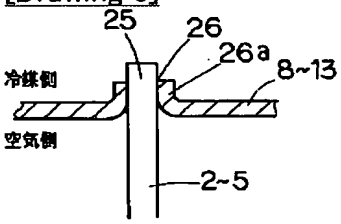
(c)



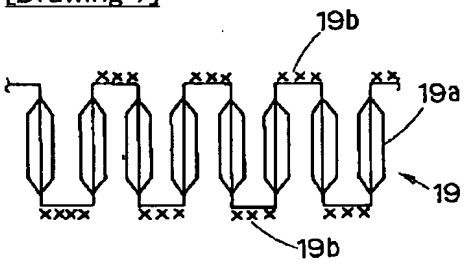
[Drawing 4]



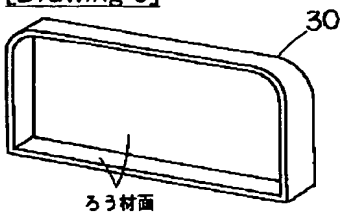
[Drawing 6]



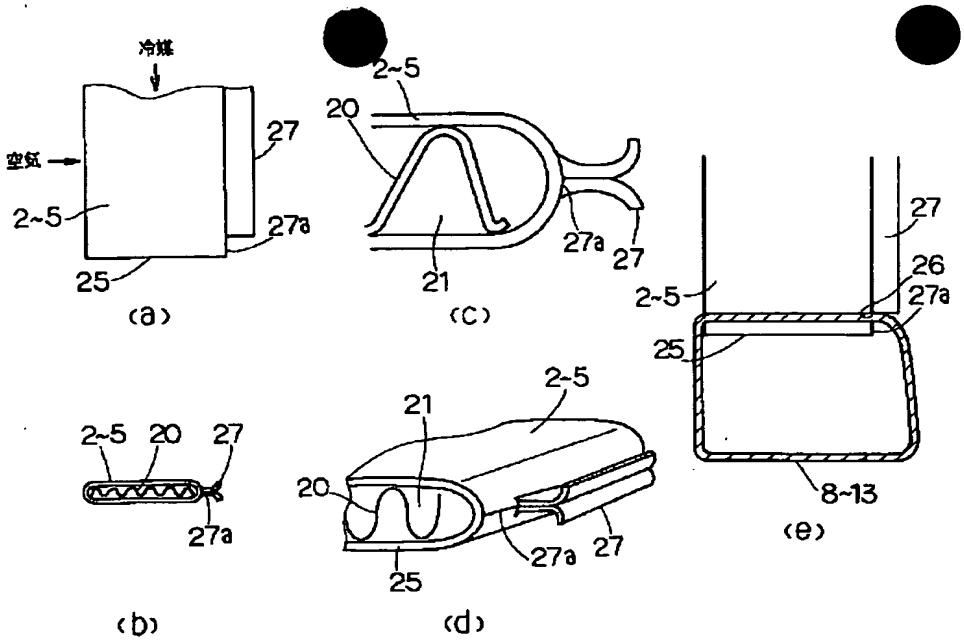
[Drawing 7]



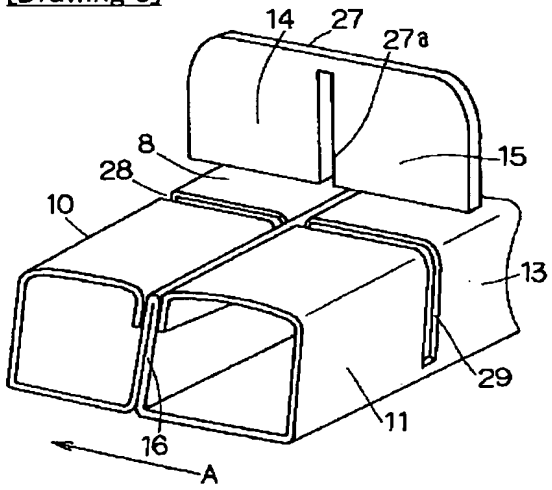
[Drawing 9]



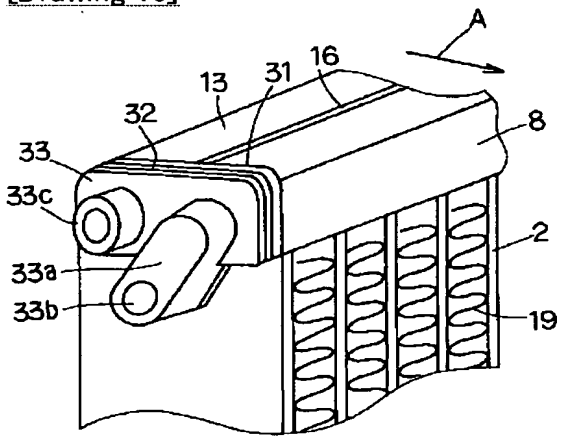
[Drawing 5]



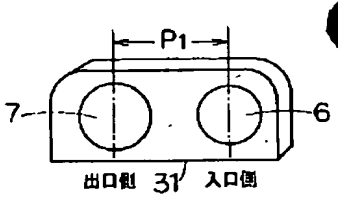
[Drawing 8]



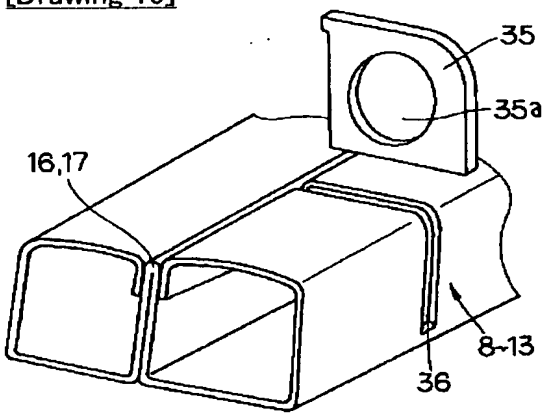
[Drawing 10]



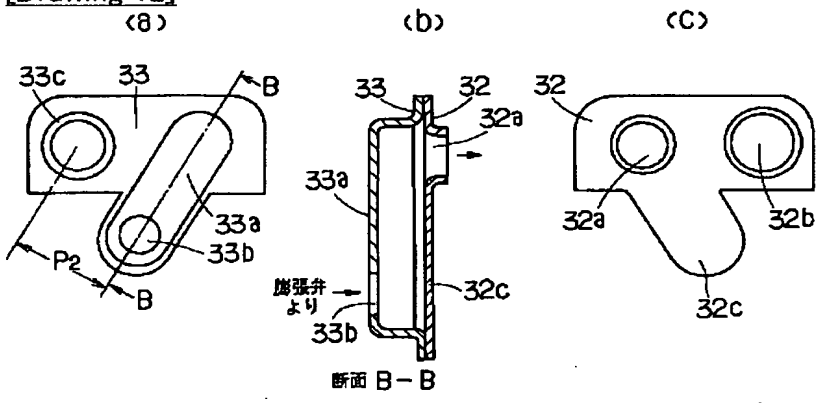
[Drawing 11]



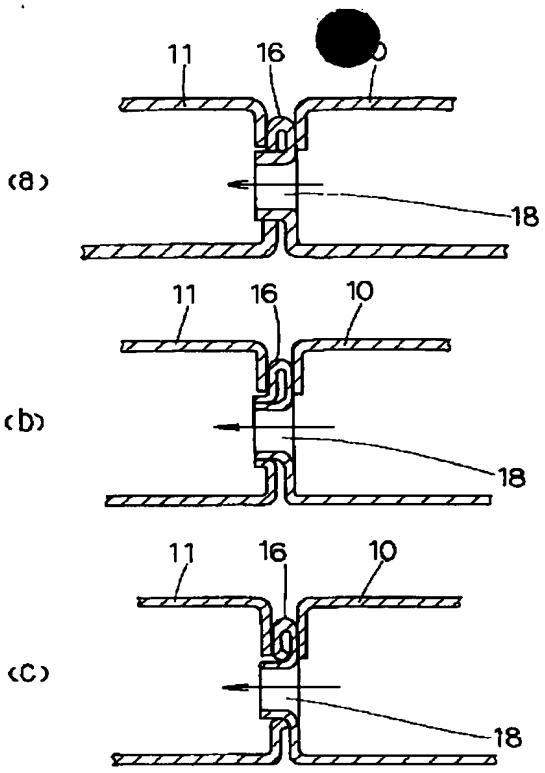
[Drawing 15]



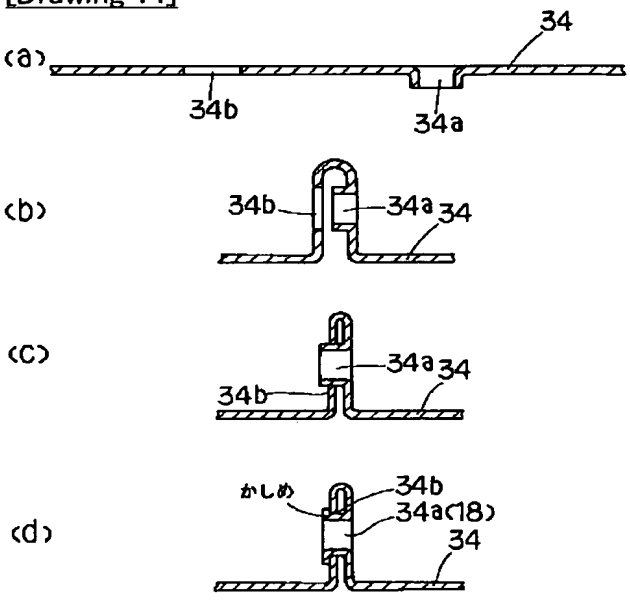
[Drawing 12]



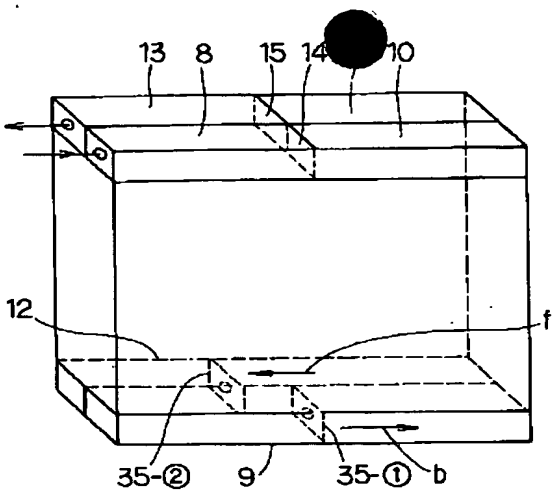
[Drawing 13]



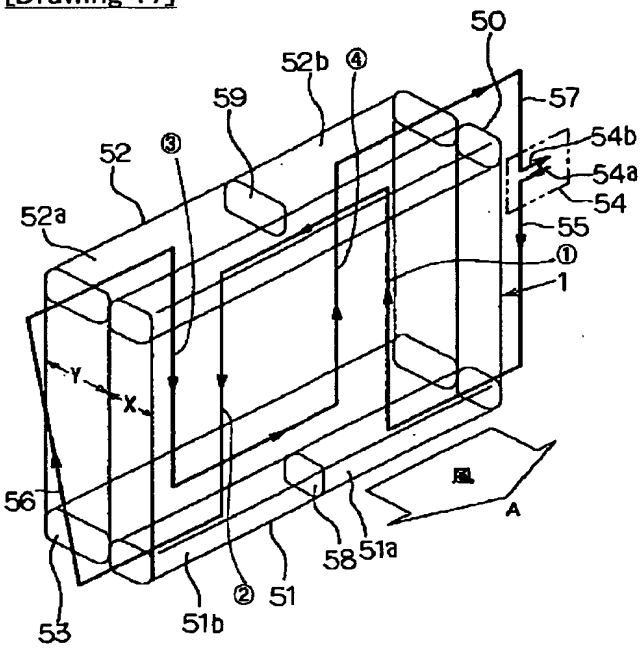
[Drawing 14]



[Drawing 16]



[Drawing 17]



[Translation done.]

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☑ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☑ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.